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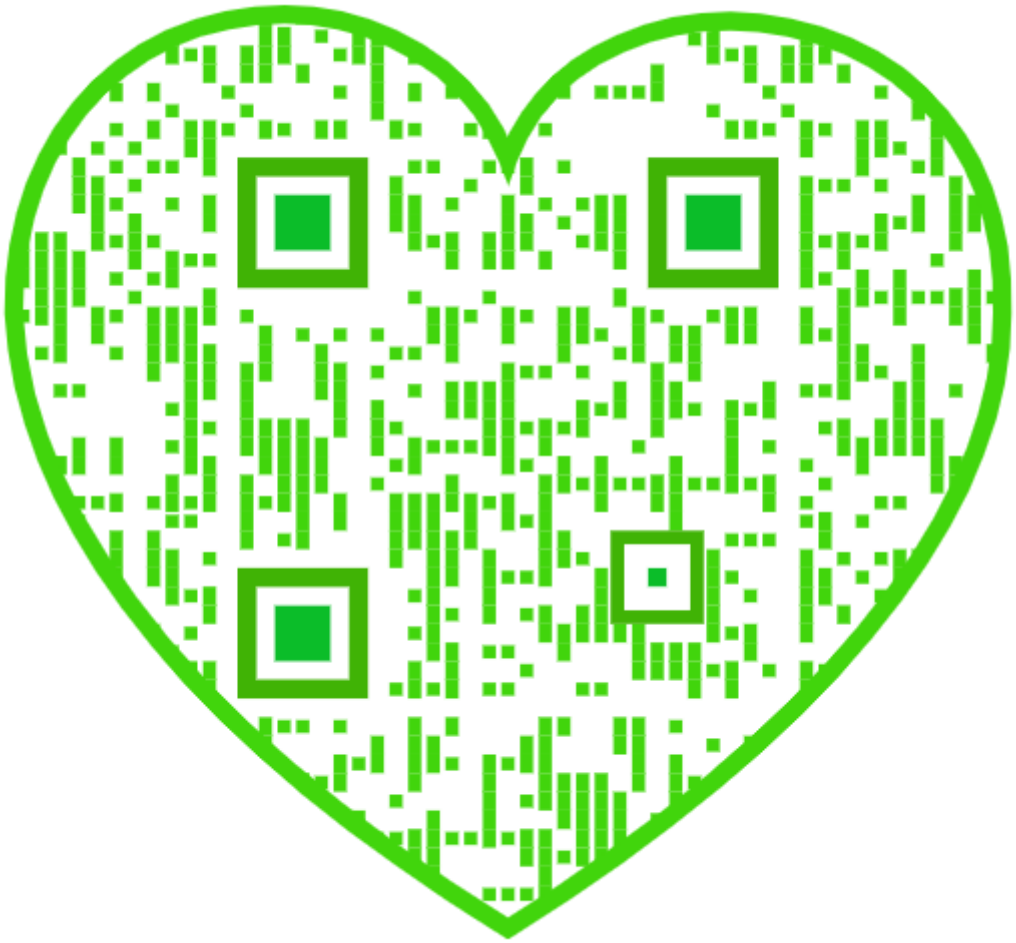
SINCLAIR TOUSEY



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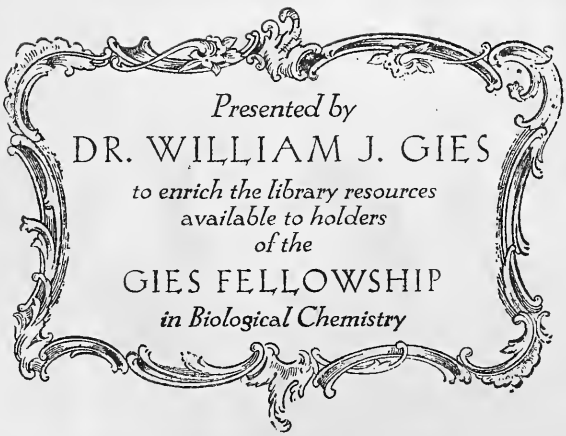

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ROENTGENOGRAPHIC DIAGNOSIS OF DENTAL INFECTION IN SYSTEMIC DISEASES

ROENTGENOGRAPHIC DIAGNOSIS OF DENTAL INFECTION IN SYSTEMIC DISEASES

BY

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PREFACE

The author has for many years been called upon to act in the capacity of adviser to dentists and physicians, not only as to diagnosis but also for treatment and prognosis. The advice in this book regarding treatment is not intended as a guide to the practice of dentistry and oral surgery, but it is hoped that it may aid the physician and the dentist to decide when an infected tooth should be extracted and when it can be cured and remain a safe and useful member.

This volume is an elaboration of articles on the same subject read before the Roentgen Ray Association of Greater New York, Jan. 27, 1916; the Bronx County Dental Society, Feb. 28, 1916; the New York State Dental Society, May 13, 1916; and the Medical Association of Greater New York, May 15, 1916.

Sinclair Tousey.

New York,
July 3, 1916.

CONTENTS

CHAPTER		PAGE
I.	Introduction	9
II.	Infections of the Teeth and Pneumatic Sinuses and Their X-Ray Diagnosis .	10
III.	Conditions from Which Alveolar Abscess and Pyorrhea Alveolaris Must Be Differentiated	29
IV.	Recent Bacteriological and Clinical Studies	36
V.	Lesions and Symptoms Secondary to Infection Connected with the Teeth or the Pneumatic Sinuses of the Face . . .	40
VI.	General Conclusions	70
	Author's Other Publications upon the X-Ray in Dentistry	71
	Index	73

ROENTGENOGRAPHIC DIAGNOSIS OF DENTAL INFECTION IN SYSTEMIC DISEASES

CHAPTER I

INTRODUCTION

"The widest publicity should be given to the fact that greatly varying and sometimes serious or fatal systemic diseases and those affecting remote organs are often due to infection connected with the teeth or with the pneumatic sinuses of the face. The infected foci are discoverable by the *x*-rays. Some of these cases are cured by treatment of the oral lesion and some require also autogenous vaccination with a bacterial culture from the pus in the oral lesion." These are the words of an eminent jurist whose wife has been dragged back from the verge of the grave through the discovery by the *x*-rays of the foci of infection in connection with the teeth. Pernicious anemia and general spinal sclerosis were threatening to destroy life. The judge's remark is the occasion for these pages.

CHAPTER II

INFECTIONS OF THE TEETH AND PNEUMATIC SINUSES AND THEIR X-RAY DIAGNOSIS

Alveolar Abscess.—This lesion sometimes develops insidiously and without local symptoms, and these are the most dangerous cases because unrecognized and untreated. Other cases pursue a perfectly frank and recognizable course as follows: There is toothache followed by a painful swelling of the jaw. These cases naturally seek relief at the hands of the dentist, but if they are neglected an abscess forms in the jaw bone surrounding the apex of the root, denuding the latter and sometimes considerably eroding it. In some cases there is more or less necrosis of the jaw. All these conditions are clearly shown with almost microscopic detail in a radiograph. The usual treatment of a fully developed alveolar abscess is by opening the pulp chamber of the tooth, removing the dead or dying nerve, draining the abscess cavity through the root-canal, enlarging the apical foramen if necessary and applying repeated dressings through the root-canal, and finally filling the latter with a nonabsorbent material. Worse cases require also amputation of the apex

of the root. Figure 1 shows a case cured by such an operation. Still others require extraction of the tooth with or without curettage of a necrotic area of bone.

The origin of an alveolar abscess is as follows: The pulp or "nerve" of a tooth is richly supplied with blood-vessels and nerves. It completely fills a cavity with unyielding walls which has a tiny opening called the apical foramen. The latter is occupied by what may be called the stem of the nerve which practically stoppers the opening. The pulp may become inflamed from any cause such as exposure to cold, a neglected carious cavity in the tooth substance or some other cause. The rigid walls of the pulp-chamber prevent any expansion of the inflamed and congested mass of "nerve" or pulp. The effect is the same as if an inflamed and congested mass of exquisitely sensitive living tissue were forcibly compressed into a space only half large enough to contain it. An analogy from general surgery is

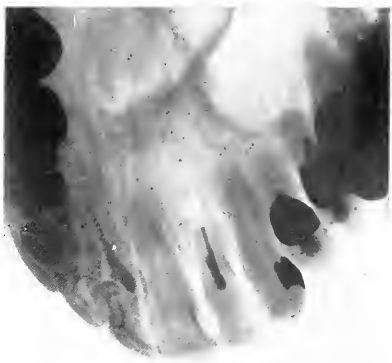

FIGURE 1.

found in the subperiosteal suppuration commonly known as bone felon, in which it is imperatively necessary to relieve tension by an incision through the periosteum.

Attention to the carious cavity, counterirritant

FIGURE 2.

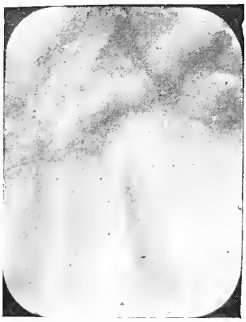

FIGURE 3.

applications to the gums and an ice bag to the cheek may relieve the congestion and the pulp may return to a normal condition.

Other cases may not have been properly treated or the congestion may have been so severe as not to yield to treatment. The inflamed pulp becomes strangulated and we have the condition known as a "dying nerve." The dentist's treatment at this stage consists in drilling into the pulp-chamber and removing the nerve. A local anesthetic makes the drilling perfectly endurable and the same application is successful in anesthetizing the

"nerve." This process has many advantages over the old method of hastening the death of the nerve by an application of arsenic. A radiograph like Figure 2 made with a small wire in the root-canal will show whether the apical foramen has been reached. The removal of a dying nerve and the treatment and filling of pulp-chamber and

FIGURE 4a.

FIGURE 4b.

root-canals commonly prevent any further trouble.

If the dying nerve is not treated, it dies and breaks down into a liquid mass of decayed tissue which often has a foul odor from the presence of microörganisms of putrefaction, commonly the *streptococcus viridans*. This purulent liquid is under pressure and the apical foramen is no longer completely blocked by living tissue. Infection passes into the alveolus or the bony socket and soon there is an alveolar abscess surround-

ing the apex of the root. Figures 3, 4a and b, and 5 are examples of alveolar abscess as it occurs in the mouths of prosperous persons whose teeth have always been carefully treated by the best dentists. Of course at a clinic one can find cases of extensive necrosis in some of the worst cases. Figure 6 is, however, of a prosperous young lady with a gold probe passing through the root-canal and a fistulous tract in the upper jaw and emerging in the nostrils. This was one of my earliest pictures and not nearly as clear as the later ones. It is especially interesting to note that the fistula healed without any operative treatment, either in consequence of the *x*-ray exposure or of the stimulation through the passage of the gold probe.

FIGURE 5.

Very many if not most of the cases of alveolar abscess referred for *x*-ray examination are connected with teeth which have already gone through the history of death and removal of the nerve.

The *x*-ray often shows in such a case that the root-canal has been only partly filled. A cavity remains in the tooth, lodging germs which keep up infection of the jaw and the general system and on occasion start an abscess in the jaw bone. Figure 7 illustrates this.

Pyorrhea Alveolaris (*Also Called Riggs' Dis-*

Figure 6.

Figure 7.

ease).—This is another disease the symptoms of which point directly to the teeth and which the dentist is naturally called upon to treat. The name implies a discharge of pus from the alveolus or tooth socket. The gums around certain individual teeth are swollen and usually red and bleeding, but sometimes white and cartilaginous. Pressure upon the gum causes an escape of a drop of pus along the neck of the tooth. And this may be repeated every five minutes. Day and night this discharge of pus and infected blood is swal-

lowed with the saliva. The pus comes from a pocket extending from the neck of the tooth perhaps even beyond the apex of the root. The root of the tooth is often covered by dense black adherent calcareous scales. (See Figure 31b, page 56, shown later in connection with a special case.) The pocket is formed by greater or less

FIGURE 8a.

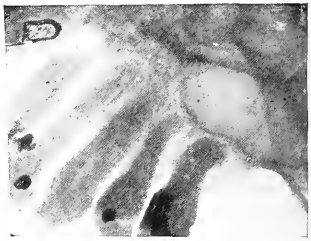

FIGURE 8b.

FIGURES 8a, 8b AND 8c.—DIFFERENT STAGES OF PYORRHEA.

absorption of the alveolar process surrounding the affected tooth. The pocket may be demonstrated by passing an instrument into it as is done by the dentist for the purpose of removing scales and applying suitable antiseptics. In the presence of the scale-covered root of the tooth and under the influence of the constant suppuration there is progressive absorption of the alveolar process until the tooth lies loosely in a large painful cavity from which it is an act of mercy to extract it. The pocket is much more clearly demonstrated by the *x*-ray as reported in the author's

various papers and clinics before dental conventions during the past twelve years.[1] The radiographs referred to and of which Figures 8a, 8b, and 8c are examples, show the location and extent of the pocket. And *in many cases the radiographs reveal the cause of the pyorrheal pocket.* A famous actress was referred to the author for treatment, by the *x*-ray and ultra-violet ray, of pyorrhea affecting the left upper central incisor. Following my usual custom, I made a radiograph of the affected portion of the superior maxilla and found an unerupted supernumerary tooth pressing upon the root of the incisor and acting as a constant source of irritation (Figure 9a). This, far from being an isolated case, is but one of numerous cases of pyorrhea originating from a similar cause. Figure 9b shows another such case. Of course, the discovery of this cause affords the key to successful treatment by removal of the un-

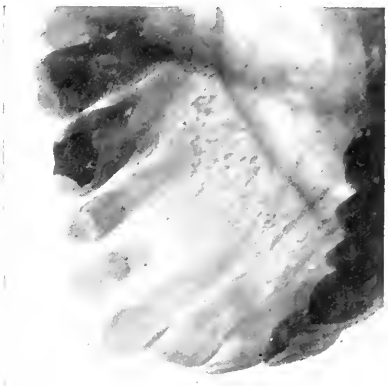

FIGURE 8c.

[1] See bibliography at end of volume.

erupted tooth, and saves the patient fruitless attempts at a cure by other means. Figure 9c

FIGURE 9a.

FIGURE 9c.

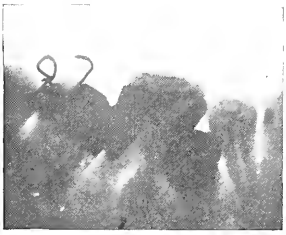

FIGURE 9b.

shows how clearly an unerupted tooth is demonstrated by modern apparatus and technique. In other cases the *x-ray* shows a root-filling extruded through the apical foramen or through a false passage and forming an irritant foreign body. Removal of the offending substance either through the root-canal by enlarging the foramen, or more effectively by an amputation of the apex of the root, cures such a case, and other methods of treatment must necessarily fail. Figures 10a

and 10b are examples, also 25b, page 46. A retained root (Figure 11a) or an instrument broken off in the bone (Figure 11b), will sometimes keep up a discharge of pus. It used to seem desirable to allow a stump to remain after the crown of the tooth had all vanished through decay. This was on the theory that any kind of a root tended to prevent absorption of the alveolar proc-

FIGURE 10a.

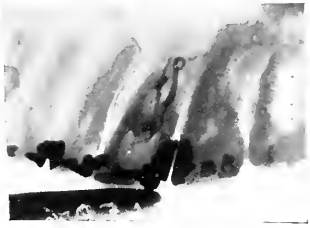

FIGURE 10b.

FIGURES 10a AND 10b.—PYORRHEA DUE TO EXTRUSION OF ROOT-FILLING.

ess and so preserve the contour of the face. Recent cases have shown that this is sometimes dangerous. In one case (Figure 33c) an alveolar abscess of such a root was the seat of infection producing cardiac and arthritic lesions. In another case (Figure 21a, page 40) infection from such a retained root started up pyorrhea in a neighboring tooth and acted as a causative factor in neurasthenia.

Pyorrhea alveolaris makes the teeth very sore and in the first case treated with the *x*-ray the pa-

FIGURE 11a.

tient, a medical student in London, had to warm his beer and cool his tea. The dental treatment also is exceedingly painful. The suffering and the inevitable loss of the affected teeth and the constant absorption of pus, both through the local circulation and also from the discharge that is swallowed, make a

FIGURE 11b.

cure extremely important, and especially before too great bony absorption has occurred.

The treatment of pyorrhea alveolaris involves the removal of any cause revealed by the *x*-ray examination. The dentist removes the hard calcareous scales from the root of the tooth and makes suitable chemical applications to the pocket. This treatment by the dentist is indispensable, but there are many cases in which these measures alone will not effect a cure. The author's own practise for the last twelve years, when such cases have been referred to him by the dentist, has been to make applications of the *x*-ray and high frequency currents from ultra-violet ray vacuum electrodes. The author was not the first to do this and has not been alone in his observations of successful results, but it certainly requires a great deal of experience and study in this particular field to make applications which shall be effective through the flesh and bone and still shall have no undesirable effect upon the skin. The practicability of this is paralleled in other fields of Roentgen ray therapy, as when an application to the knees in a case of leukemia produces an effect upon the bone marrow, the nursery of white blood cells, reducing the number of leukocytes from perhaps 200,000 to perhaps 60,000 per cu. mm. Figure 12a is of a case of pyorrhea alveolaris referred to the author by Dr. Van Saun.

Very extensive pockets were present about several teeth and had persisted in spite of dental treatment. A course of twelve applications of the *x*-ray and the ultra-violet ray resulted in a complete cure and at the last report, three years later, there had been no relapse. Some other cases require a longer course of treatment and some have

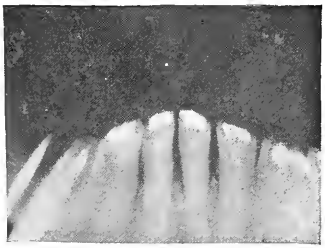

FIGURE 12a. FIGURE 12b.

FIGURES 12a AND 12b.—PYORRHEA ALVEOLARIS BEFORE SUCCESSFUL TREATMENT BY X-RAY AND HIGH FREQUENCY CURRENTS.

occasional relapses which are disposed of by dental treatment and a very few *x*-ray and ultra-violet ray applications. Figure 12b is of another case of pyorrhea cured by the *x*-ray and high frequency currents.

In case after case, the pain and swelling and discharge have ceased and the loosened teeth have become firm again. *During the discussion of one of the author's papers at the meeting of the Roentgen Ray Society of Greater New York, this obser-*

vation was corroborated by Dr. Goldberg, who had treated pyorrhea at one of the large hospitals.

It should be noted that the author does not recommend this treatment as a substitute for treatment by the dentist, but only as an adjunct when dental treatment fails.

The author regards this as the method of election and has applied it to members of his own family as well as to strangers.

There is a new method of treatment for pyorrhea alveolaris which is having world-wide publicity at the present moment and which, if successful, will have the advantage over the *x*-ray of not requiring special apparatus or special skill and of being therefore very much less expensive. This is by the use of the ipecac alkaloid emetine. This substance acts very powerfully upon the endameba which is assumed by the proposers of the treatment to be the cause of pyorrhea alveolaris. So far some favorable reports have been published, but the author has heard it denounced in unmeasured terms by patients upon whom it had been tried without a particle of benefit. It is evidently too early to form a final opinion as to the value of the emetine treatment of pyorrhea alveolaris, but if it fails in a given case or should prove generally unreliable, one has the tried and proven *x*-ray and ultra-violet ray as a reliance.

One of the worst cases of local infection the author has ever seen was referred for *x*-ray examination by Dr. M. H. Brown. There was a cavity in the lower jaw opening in the mouth behind the last molar tooth. A yard of the foulest gauze packing was drawn out and it seemed as if nothing short of cancer could possibly produce such a mass of corruption. The radiograph, Figure

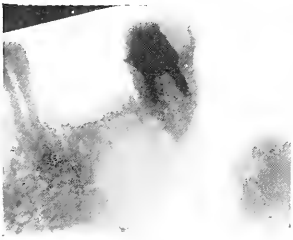

FIGURE 13a.

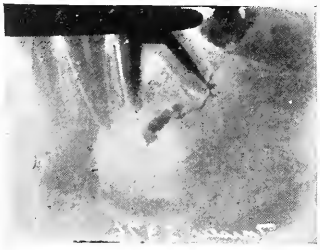

FIGURE 13b.

13a, showed a large thin-walled cavity in the lower jaw at the bottom of which was an unerupted supernumerary tooth. The latter lay far from the ordinary tooth-bearing area.

Another case, referred by Dr. Fellowes Davis, presented swelling and a fistulous opening. Into this was injected a bismuth paste by means of which the radiograph Figure 13b showed the path of the fistulous tract and its origin in a root at a distance from the swelling.

Several years before the discovery of the *x*-ray, a case was referred to the author. A fistula had

FIGURE 14.—EMPYEMA OF ANTRUM.
Needless sacrifice of all the upper teeth for pain.

been discharging externally under the angle of the jaw for seven years in spite of treatment by the best physicians, and I was asked to recommend a good skin specialist. It seemed desirable to introduce a probe which led up through the jaw bone to the root of a tooth. And it was a simple enough matter under a general anesthetic to extract the tooth and curette the bony socket and the entire length of the fistulous tract. The latter was permanently healed in ten days.

The above is a brief exposition of some of the local lesions directly affecting the teeth which may form the focus of constitutional infections producing an amazing variety of secondary lesions and symptoms.

The Focus of Infection Not Always Connected with the Teeth.—A case in point was one in which an eye and ear specialist had for two years and a half suffered tortures from pain, and had constitutional symptoms for which the ethmoid cells had been scraped out and every upper tooth extracted. The pain continuing, spicules of bone had been cut out of the upper jaw by rongeur forceps. A number of radiographs showed no retained broken root of a tooth as had been suspected and no alveolar abscess. A radiograph of the whole face (Figure 14), however, showed that one antrum was absolutely opaque. It was operated on by Dr. Cryer, of Philadelphia,

who removed a mass of pus and granulation tissue and the pain was cured. If the *x*-ray had been resorted to in the beginning, two and a half years of suffering and the useless extraction of all the upper teeth would have been avoided.

The *x*-ray will reveal any source of infection connected with the teeth or the pneumatic sinuses of the face, if these are present. If these were undiscovered and untreated, the most serious consequences might follow which could easily have been averted and which may be exceedingly difficult to cure after they have developed. A case in point is described later in which the author discovered the cause, but the teeth seemed perfectly sound to the dentist with his usual means of examination. The patient, himself a physician, had terrible neuritis, high blood pressure and eventually died of apoplexy, apparently from neglect to remove the cause in time.

CHAPTER III

CONDITIONS FROM WHICH ALVEOLAR ABSCESS AND PYORRHEA ALVEOLARIS MUST BE DIFFERENTIATED

PULP-STONES.—These are calcareous concretions in the pulp or "nerve" of the tooth. They cause pain, and the patient comes for a radiograph which is expected to show the location of an alveolar abscess. The picture, however, shows an area of density in what should be the perfectly transparent contents of the pulp-chamber. The "nerve" is more or less irritated and there is as in Figure 15 a slight departure from the normal appearance of the bone surrounding the apex of the root. Such cases are treated by removal of the "nerve."

FIGURE 15.

MALOCCLUSION.—Pain, similar to that of chronic alveolar abscess, and very slight radiographic indications of apical irritation, may occasionally be simply the result of constant pressure, this tooth alone making contact with the opposing teeth when biting or chewing. The dentist can remedy the cause by regulating the teeth slightly or by

grinding the surface of this tooth or the one it collides with. This explanation of the case should be accepted with more than the traditional grain

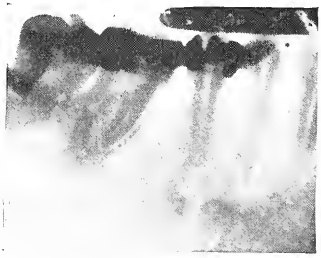

FIGURE 16a.

FIGURE 16b.

FIGURE 16c.

FIGURES 16a, 16b AND 16c.—APICAL ABSCESS IN CASE OF ARTHRITIS, ENDOCARDITIS, MENINGITIS, PLEURISY, PNEUMONIA AND HEMIPLEGIA.

Discomfort at first considered due to malocclusion.

of salt. Of course if the pain ceases and the radiographic appearance becomes normal, that is all that can be desired. But if more or less dis-

comfort remains and the radiographic appearance continues distinctly abnormal, the case should not be temporized with even though the usual tests by the dentist indicate a vital and healthy tooth. Figures 16a and 16b show the progress of such a case under expectant treatment. The symptoms and radiographic appearance at the start were as described above. Grinding the surfaces of the opposing teeth did away with their collision, but the discomfort and abnormal radiographic appearance persisted for years. Then there was an attack of intense pain necessitating the use of morphin and accompanied by swelling and suppuration. This required months of treatment through the root-canal. Figure 16c shows the same tooth a year later with the root filled to the apex and surrounded by healthy bone. It proved to be sterile when extracted (page 49).

The treatment of just such a case should, according to the author's view, consist in drilling into the tooth and removing the dead or dying or simply chronically irritated nerve. This should be done before its putrid decomposition has poisoned the alveolus or bony socket almost beyond recovery.

The very serious subsequent developments in the case of this patient are described at page 46.

Cysts.—A cyst in either the upper or the lower

jaw may cause symptoms resembling those of alveolar abscess and the radiographer should be careful to differentiate between the two. In a recent case (Figure 17a), treated by Dr. Clawson, there was a large area of transparency between the roots of the lateral incisor and the canine.

FIGURE 17a.

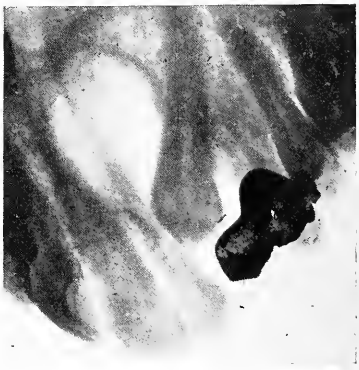

FIGURE 17b.

Both these teeth had healthy "nerves." The cyst contained a clear straw-colored liquid and was successfully treated by incision, curettage and packing without disturbing the two neighboring teeth. Figure 17b shows a cyst accidentally revealed in a radiograph made to determine the presence of an unerupted upper canine tooth in a man 45 years old. A large, thin-walled, clearly defined cavity is frequently a cyst; while an alveolar abscess often is evidenced by decalcification

gradually shading off into healthy bone without a distinct line of demarcation.

A *dentigerous cyst* commonly shows as a hard swelling upon the jaw and is essentially a cavity in the bone wherein lies an unerupted and usu-

FIGURE 18a.

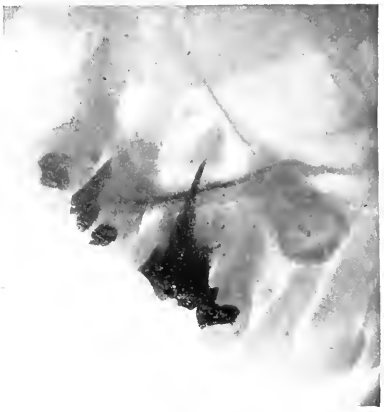

FIGURE 18b.

ally supernumerary tooth. Exceptionally the *x*-ray shows that such a swelling is an odontoma, a tumor of almost stony hardness and consisting of a conglomeration of nodules of dentine covered by enamel.

ALVEOLAR ABSCESS AND UNERUPTED TOOTH COMBINED.—In a patient seventy years old with painful swelling of the lower jaw, the dentist could not determine whether the cause was an unerupted tooth or an alveolar abscess. The radiograph (Figure 18a) showed that both conditions were present. Another patient aged fifty years was

FIGURE 19a.

referred for an examination to determine the presence of an unerupted upper canine. The radiograph (Figure 18b) showed the unerupted tooth and an unsuspected alveolar abscess of an upper molar.

An IMPACTED WISDOM TOOTH lying perhaps in a

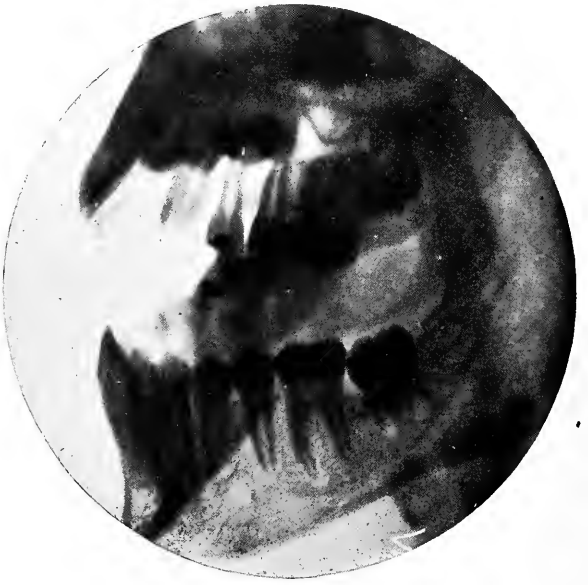

FIGURE 19b.

Flaring apical foramina of the 12-year molar are normal. Abscess of the anterior root of the 6-year molar.

horizontal position concealed in the jaw and growing directly against the root of the second molar, causes pain suggestive of neuralgia or neuritis. It is mentioned in this place because of the misinterpretation that has sometimes been made of the radiographic appearance. The unerupted tooth (Figure 19a) lies in a natural cavity in the jaw and if the root is not fully developed a transparent area is seen at that end. This represents soft tissue in which tooth substance is developing and is not an abscess.

The FLARING FORAMEN of a still growing tooth in a young person should not be mistaken for an abscess. Figure 19b shows a case with both abscess and this normal appearance.

CHAPTER IV

RECENT BACTERIOLOGICAL AND CLINICAL STUDIES

Hartzell, Henrici and Leonard [1] have been able to verify the statement that "para-apical abscesses and pyorrheal pockets both harbor streptococci which will induce in animals inflammation of the heart muscle, vegetations in heart valves, infected joints, inflammation in blood-vessels, inducing vascular lesions and both focal and diffused infections of the kidneys." During the past year they found similar post mortem human lesions particularly of the heart valve, heart muscle and kidney, which they believe are produced by the same organisms. The medical department of the Minnesota University Medical School report that 12 per cent of the individuals admitted to the hospital are suffering from conditions due to mouth infection. Their bacteriological work shows the constant presence of the streptococcus viridans in chronic dental abscesses and pyorrheal pockets and a sterile condition of healthy teeth. Hemolytic streptococci are absent from these abscesses and from pyorrhea. The pneumococcus is absent.

[1] The report of The Minnesota Division of the Scientific Foundation and Research Commission, *Journal of National Dental Association,* November, 1915.

Their studies convince them that peridental inflammations are primary lesions, the organisms gaining access to the tissues either through the pulp canal or at the gingival margin, and not secondary to some other focus. Their studies of the endameba buccalis confirm the statement of Bass and others that these organisms are practically always present in diseased mouths, but they do not find them most numerous in the deep parts of the pockets nor in the tissues. They find these amebae in the pus which contains their natural food, this being bacteria and pus cells. They are unable to confirm a causative relation between the endameba and pyorrhea and alveolar abscess.

In the medical wards they have studied especially arthritis, acute and chronic ulcer of the stomach, heart lesions, pernicious anemia, nephritis and nervous diseases of the neuralgic type. They find no important distinction between dental abscess and pyorrhea as causative factors in these diseases. Either is frequently the sole cause and even in cases originating from tonsillar or other large focus of infection, the presence of pyorrhea or dental abscess will keep up the disease after the large focus has been cured. All these cases are markedly improved by complete extirpation of these foci of infection. To quote from Dr. Leonard's report:

"A minute examination with every means available is necessary. With the aid of the *x*-ray and careful exploration, it is still difficult to find all foci about the teeth. Without these aids it is impossible. When a physician refers a patient suffering from rheumatism or other disease liable to come from dental infection, it is impossible for the dentist to make a complete determination without the use of the *x*-ray. It is our experience and the experience of others who use the *x*-ray a good deal that the majority of dental abscesses give no clinical sign of their existence. The teeth are not sore, no swelling or palpable soft spot at the root end reveals what the radiograph shows and what the subsequent operation confirms. It is not uncommon to find abscesses shown in the radiographs in cases in which there are no breaks in continuity of the pulpal wall, as under crowns, fillings or even sound teeth.

"Experience with radiography also shows that a very large proportion of artificially filled roots subsequently become abscessed. A study made by Dr. Henry Ulrich of Minneapolis of a thousand radiographs taken at random indicated that over 70 per cent of the artificially filled roots were abscessed. We partially checked this up by looking over a hundred, in which, according to our diagnosis, over 60 per cent of such were abscessed. A consideration of the necessary means to do away with this condition is out of place in this report. The point is, that this must be taken into account in a determination of dental foci in cases suffering from systemic disease. It has been very rare that we have extracted a tooth which showed an abscess in the radiograph and failed to get streptococci when we cultured from

the root end. Our technique is such that contamination in making these cultures seems impossible.

"It is amazing to find in well cared for mouths how much pyorrhea may exist without being evident except to painstaking exploration. To those familiar with systemic results coming from pyorrhea in such a large proportion of cases and even from a slight pyorrhea, the careless ignoring and overlooking of such trouble on the part of most dentists, seems nothing less than malpractise.

* * * * * * *

"The last year's work has thrown some doubt on the advisability of the use of vaccines in all of the cases. There is no question but that brilliant results frequently follow the use of autogenous vaccines or even those prepared for similar lesions in other patients. A vaccine prepared in the case of Miss A. F., whose case is given above, was used by one of the physicians for another rheumatic case, in his opinion with satisfactory results. *The use of vaccines, however, is liable to create a confidence in them which is likely to make the dentist less careful in eliminating all local foci, and until such local foci are removed it can hardly be expected that a vaccine will give any permanent relief.* In most of the cases where we were sure that all local foci were removed the recovery was sufficiently rapid and complete to indicate that vaccine was not needed."

Four cases had a diagnosis of myocarditis and three of pericarditis. Removal of the causative foci of infection prevented further damage to the heart in valvular cases and general medical measures were adopted to favor compensation.

CHAPTER V

LESIONS AND SYMPTOMS SECONDARY TO INFECTION CONNECTED WITH THE TEETH OR THE PNEUMATIC SINUSES OF THE FACE

TUBERCULOSIS.—It has long been known[1] that one of the common sites of infection in pulmonary, bony and glandular tuberculosis is an alveolar abscess. And the continued existence of such a pus pocket is, therefore, a distinct menace to life itself. Figure 20 shows such an abscess in a patient shortly before death from tuberculosis.

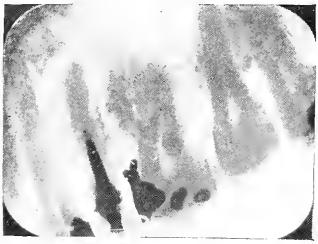

FIGURE 20.

NEURASTHENIA.—A man

FIGURE 21a.

FIGURE 21b.

[1] Tousey, "Medical Electricity, Roentgen Rays and Radium." W. B. Saunders Co., Philadelphia.

FIGURE 22.—FRONTAL SINUS OPAQUE IN A CASE OF NEURASTHENIA. ANTEROPOSTERIOR VIEW.

FIGURE 23.—FRONTAL SINUS OPAQUE IN A CASE OF NEURASTHENIA. LATERAL VIEW.

of powerful physique and weighing 220 pounds, was lately referred to me suffering from neurasthenia. He complained chiefly of not being able to stand as much business activity and responsibility as one of his apparent strength would be

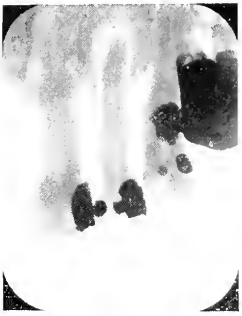

FIGURE 24.—ALVEOLAR ABSCESS IN DIGESTIVE NEURASTHENIA AND FURUNCULOSIS.

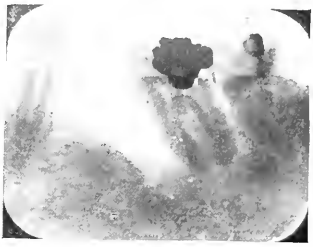

FIGURE 25a.—PYORRHEA IN SPINAL ARTHRITIS.

expected to. There had been no dental but some nasal symptoms.

The radiographs showed several pyorrheal pockets including (Figure 21a) one of the right lower second bicuspid due probably to irritation from the retained and infected roots of the first molar. An antero-posterior and also a lateral radiograph of the head showed the frontal sinus to be opaque either from pus or some other opaque substance or because of congenital absence of the

frontal sinus. Dr. Culbert, the rhinologist, thinks the latter is the case.

In another case of neurasthenia applying to the author for *x*-ray examination, the radiograph (Figure 21b) showed an alveolar abscess with erosion of a considerable part of the root. The canal was only partly filled and the foramen wide open.

FIGURE 25b.

FIGURE 25c.

ARTHRITIS has become known within the last few years to be frequently due to toxemia originating from and maintained by an alveolar abscess or pyorrheal pockets. Figures 25a, 25b and 25c illustrate dental infections in these cases. And since this discovery many a case of acute or chronic "rheumatism" has been cured in a short time by treating the focus of infection.

ARTHRITIS, PLEURISY, ENDOCARDITIS, MENINGITIS AND HEMIPLEGIA.—A patient was referred to on page 30 with a lower first bicuspid which the dentist at first thought was simply irritated by

striking against an upper tooth. This went on to the formation of an alveolar abscess. Following prolonged treatment through the root-canal the tooth was filled.

Figure 26 shows this tooth in an apparently cured condition. The root filling reaches about to the apical foramen and the surrounding bone has regenerated. During the latter part of the summer, the patient began to complain of renewed discomfort and wanted to have the tooth extracted, but a radiograph showed it to be all right. There was a peculiar appearance to the adjacent second bicuspid. Then followed a series of fugitive attacks of arthritis, myositis and neuritis. Each attack lasted a week or ten days and produced very severe pain. During these two months the patient lost twenty pounds in weight and at times had a slight rise in temperature. A diet from which sugar and meat were excluded and medication by aspirin, salophen and sodium salicylate produced little or no effect. Finally a few applications of high frequency currents from ultra-violet vacuum electrodes seemed to have brought these attacks to an end. On December 5th, however, she was seized by sudden severe

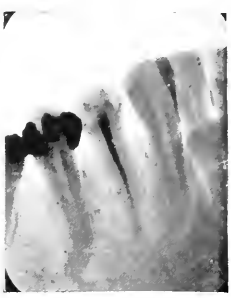

FIGURE 26.

pain in the left upper quadrant of the abdomen with great rigidity of the left rectus muscle. This pain was not relieved by laxatives and enemata and gradually extended to the left side of the chest, where in two or three days the physical signs of pleurisy with effusion developed. The heart was greatly dilated and there were rasping mitral murmurs. Absolute rest in bed, a purin-free diet and an ice bag over the heart temporarily reduced the severity of the symptoms without much change in the physical signs.

After five weeks of this acute illness, Dr. Harlow Brooks in consultation found that she presented the clinical picture of tubercular peritonitis and tuberculous pleurisy on the left side. There was also flatness at the base of the right lung behind, which with the onset of meningitic symptoms and constant leukocytosis led to a suspicion of abscess which was disproven by an exploratory puncture.

The meningeal symptoms became rapidly worse; the patient was unable to speak a connected sentence. There were several severe convulsions lasting from an hour to an hour and a half each. A spinal puncture showed a clear fluid under normal pressure and containing no microörganisms, and negative to the Wassermann test. The spinal fluid contained one lymphocyte to about 15 red cells. The blood contained no microörganisms and

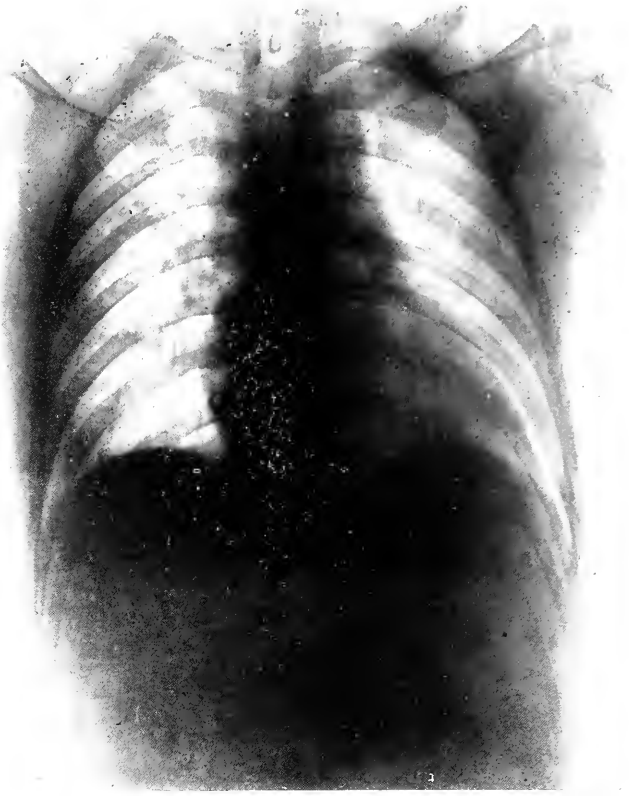

FIGURE 27.—DILATED HEART. ENLARGED THYMUS AND MOTTLING OF LUNG.

Case of arthritis, endocarditis, pleurisy, pneumonia, meningitis and hemiplegia from dental infection.

was negative to the Widal and Wassermann tests and contained 25,000 leukocytes per cubic millimeter. The urine contained albumin and casts. A radiograph of the chest (Figure 27) made with a portable outfit showed no collection of fluid in either side of the chest, but mottling on the right side. It showed a greatly dilated heart and an enlarged thymus gland. The pulse was 120, respiration 34, temperature 102½ degrees F.

Dr. N. B. Potter and his assistant, Dr. Ordway, had always been suspicious of streptococcus infection, possibly from the teeth shown in my radiographs. And it had been the plan that the first time the patient went out of doors it should be to the dentist's office to have the suspected second bicuspid drilled into and the question of the life or death of its nerve decided. It had now become evident, however, that it was a question of the life or death of the patient to discover and remove the source of infection at once unless it should prove to be tubercular and not removable. Dr. Henry Sage Dunning accordingly operated upon the patient in bed under local anesthesia. He extracted the originally infected first bicuspid without difficulty. The hooked root of the second bicuspid broke off as had been anticipated and had to be chiseled out. The operation took about two hours, but was entirely painless.

Improvement in every particular began from

that moment. The original tooth was found to be sterile, but a culture of the streptococcus viridans was obtained from the second bicuspid and on the fifth day after the operation inoculations with autogenous vaccine were begun. After this the improvement was more rapid and on the thirteenth day after the removal of the teeth the respiration was 24, pulse 74, temperature 98 de-

FIGURE 28.

FIGURE 29.

grees F., and the patient's strength increasing daily. The physical signs were clearing up. The subsequent course of this case has been remarkable. The patient has recovered from an attack of pneumonia and has partly recovered from hemiplegia supposed to be due to an embolus. She is still in bed running an irregular septic temperature and the only treatment that seems to have any beneficial effect is the inoculation with a dead culture of the streptococcus viridans. It is believed that if her strength holds out her resistance to the infection will be increased to such

FIGURE 30.—UNERUPTED TOOTH IN THE LOWER JAW.
Facial neuralgia for which extirpation of the Gasserian ganglion was planned.

an extent as to bring about recovery. The case at present seems to be one of endocarditis with vegetations upon the heart valves which occasionally produce infarctions in such organs as the spleen and kidneys, where the consequences are very serious.

NEURITIS, NEURALGIA, TIC DOULOUREUX, SCIATICA, constitute a group of cases in which one's first thought is to determine the presence or absence of a cause connected with the teeth or sinuses, for no ordinary medical agents will avail if the trouble is due to such a cause. Figure 28 is an example of positive findings in these cases. Figure 29 shows one of the dental foci of infection in a case of headache persisting for 3 or 4 years in spite of medical and hygienic measures. Another patient had very severe tic douloureux spasms of pain at a few seconds' interval, feeling exactly as if a tack were driven into the jaw bone. The *x*-ray and high frequency currents from ultra-violet ray vacuum electrodes gave a great deal of relief, but the final cure was accomplished through overcoming intestinal auto-intoxication, which appears to have been the underlying cause. The negative *x*-ray findings saved the patient from needless and ineffective sacrifice of his teeth. Figure 30 is of a case referred by the late Wm. T. Bull. The patient had been treated by neurologists and electrologists in this country and Paris

for trigeminal neuralgia which had persisted for three years. Dr. Bull had arranged to perform an operation for the removal of the Gasserian ganglion, but as a final preparatory step sent her for an *x*-ray examination. The pictures showed an unerupted tooth near the angle of the jaw, which Dr. Bull operated upon with a cure of the dis-

FIGURE 31a.

FIGURE 31b.

ease and the patient was saved the fruitless suffering and danger of an intra-cranial operation.

PAROXYSMAL COUGH.—Such a case in a man who has recently become blind, was referred to the author by Dr. Osborne. The radiographs, among them being Figures 31a and 31b, showed alveolar abscess and numerous pyorrheal pockets. Dental treatment not having been begun, the calcareous scales are clearly visible upon the root of one of the lower centrals.

Cases of ARTERIAL HYPERTENSION, leading to AR-

TERIOSCLEROSIS with many distressing symptoms and a prospect of apoplexy and death, call for an *x*-ray examination of the teeth and pneumatic sinuses. Figure 32a showed extensive pyorrheal and abscess areas about the teeth. The patient was professor of laryngology and rhinology in one

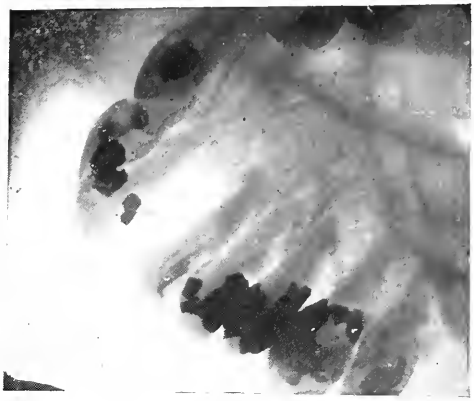

FIGURE 32a.

of our universities and had been referred to me for treatment of neuritis of the arm. He was under treatment elsewhere for high blood-pressure, which I thought was of the same toxic origin as the neuritis. Suspecting dental infection, I made the radiographs which showed the area of infection. I most strongly urged treatment either by extracting the affected teeth or by applications made through the root-canals. The dentist, however, found the teeth healthy according to his

tests and refused credence to the *x*-ray findings. It was before the general recognition of this source of systemic infection and so the doctor was allowed to go from bad to worse until he was in a desperate condition in the Battle Creek Sanitarium. There he met a dentist who believed the

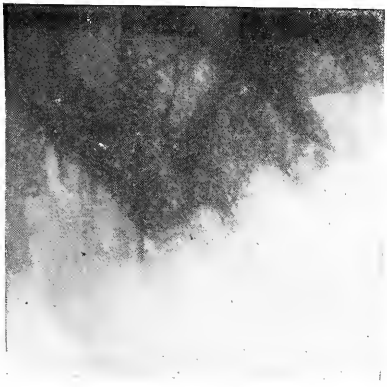

FIGURE 32b.

FIGURE 32c.

story told by the radiographs. A number of terribly abscessed teeth were extracted with immediate and marked constitutional benefit, but on his return to New York the radiograph (Figure 32b) showed other infected areas remaining in the upper jaw from which all the teeth had been extracted and in a few weeks he died of apoplexy. Timely extraction of all the infected teeth, I believe, would have saved this useful life. He was only 56 years old.

Figure 32c is of a lady with HIGH BLOOD-PRESSURE, seldom lower than 220, and with auricular fibrillation and occasional syncope—altogether

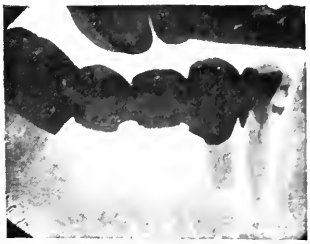

FIGURE 33a.

FIGURE 33b.

FIGURE 33c.

FIGURES 33a, 33b AND 33c.—ALVEOLAR ABSCESSES IN A CASE OF MITRAL INSUFFICIENCY.

calling for the immediate sacrifice of the infected teeth if her life is to be saved.

CARDIAC LESIONS secondary to dental infection with its accompanying rheumatism, nephritis or

neuritis, were endocarditis in twenty-three out of thirty-one of Hartzell, Henrici and Leonard's cases and were evidenced by valvular disease, usually mitral insufficiency. Four cases had a diagnosis of myocarditis and three of pericarditis. Removal of the causative foci of infection prevented further damage to the heart in valvular cases and general medical measures were adopted to favor compensation.

Cardiac lesions have already been referred to; and Figures 33a, 33b and 33c are of a case in which they are the most important result of dental infection. The patient has a mitral murmur, mitral regurgitation with some compensatory enlargement of the heart, but no edema of the extremities or dyspnea. Getting up quickly from a reclining posture would cause him to drop back practically in a faint and he has to avoid turning suddenly for the same reason. The urine contains numerous granular casts, calcium oxalate, uric acid and formerly contained albumin. The recent occurrence of a swelling of one or two finger joints and one knee caused him to have radiographs made of all the teeth. Pyorrheal pockets were found about several teeth; and there were three alveolar abscesses with considerable destruction of bone. The three abscessed teeth were extracted. The first two contained no pathogenic microörganisms. The third yielded a culture of strepto-

coccus viridans from which an autogenous vaccine has been prepared.

Exophthalmic Goitre.—This is a disease in which an *x*-ray examination of the teeth is very necessary. Arising in youth as it often does, it might seem unlikely that a dental infec-

Figure 34a.

Figure 34b.

tion should have been present as an exciting cause. Figure 5 (page 14), however, is a picture of a young girl with an alveolar abscess, and Figure 19b (page 34) is another. In nearly every family some case of dental abscess can be found to have occurred during youth or childhood. Those with manifest symptoms have usually been treated more or less successfully, but the *x*-ray alone would have disclosed those with an insidious course. Figures 34a and 34b show typical dental *x*-ray findings in exophthalmic goitre. In one case there had been alveolar abscesses of two

lower molars for a long time. In the other case all the upper and lower teeth except two or three isolated ones had been lost through pyorrhea.

Eye Diseases.—Some of the cases which were

Figure 35a.—Alveolar Abscesses in Case of Tinnitus Aurium.

Figure 35b.

Figure 35c.

Figures 35b and 35c.—Alveolar Abscesses and Pyorrhea in Case of Pernicious Anemia and Spinal Sclerosis.

formerly diagnosed as due to rheumatism or to syphilis have been found to be due to dental infection. The uveal tract including the choroid, the ciliary body and the iris, is most apt to be affected by

this cause. Cases have been known in which even one eye has been lost and this cause of infection discovered in time to save the other. The patient represented by radiograph No. 16 had *neuroretinitis* as an effect of meningitis and at another stage *episcleritis* as a direct effect of the infection or as a reaction from the autogenous vaccine. The patient in radiographs Figures 31a and 31b became blind and without any perception of light shortly before the infection was discovered, but perhaps not in consequence of it.

Tinnitus aurium was the symptom complained of by a patient referred to me by Dr. Clawson. The radiographs showed no dental lesion. Figure 35a, on the other hand, shows three alveolar abscesses in a physician with a noise as of ten thousand crickets in each ear. The ringing in the ears may in other cases be an indirect result due to high blood-pressure caused by the dental infection.

Spinal cord lesions have recently been recognized to be sometimes due to infection arising from the teeth. Figures 35b and 35c, are of a patient of Dr. Solley's, with pernicious anemia and numbness and loss of power in the upper and lower extremities. She was in a desperate condition with hemoglobin of 33 and becoming weaker every day. Dr. Pearce Bailey found positive evidence of general, not merely lateral, spinal sclerosis with symptoms indicating a stage of ir-

ritation rather than destruction of the nerve fibers and cells and with a possibility of partial or complete cure if the source of infection could be discovered and removed. The radiographs showed alveolar abscesses of several teeth. These teeth were extracted and an autogenous vaccine of the streptococcus viridans administered which was prepared from the pus. The same germ had been found in this patient's blood. There has been immediate improvement in her general condition and restoration of power in the arms but there is still a paretic condition of the lower extremities.

Gastric Ulcer.—The most surprising success has been reported by Hartzell, Henrici and Leonard [1] in the treatment of gastric and duodenal ulcer. Unmistakable cases were cured so promptly as to indicate a causative relation between the dental infection and the destructive process in the gastric wall. We cannot tell which of the two factors is most important. There is the irritation from the infected matter which is constantly swallowed with the saliva and there is the hematogenous infection. The demonstration of this easily discoverable and removable cause of many cases of gastric and duodenal ulcer, is a fact of great importance. Consider the number of

[1] Report of the Minnesota Division of the Scientific Foundation and Research Committee, *Journal of National Dental Asso ciation*, November, 1915.

these cases coming to the roentgenologist for diagnosis after months or years of pain and loss of weight and strength. Also the tendency to recurrence after medical treatment and the tendency to produce adhesions interfering with gastric and intestinal digestion and transit. Also the danger

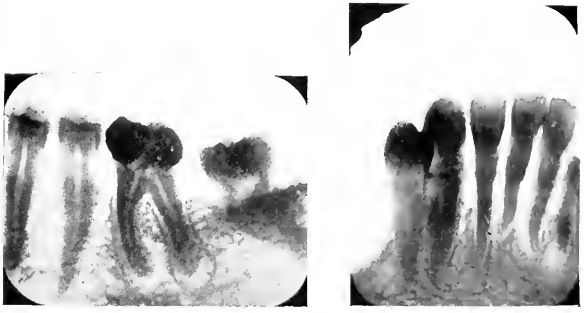

FIGURE 36a. FIGURE 36b.

FIGURES 36a AND 36b.—ALVEOLAR ABSCESSES AND PYORRHEA IN TWO CASES OF GASTRIC ULCER.

of adhesions following operative treatment and the ever-present danger that a chronic ulcer will develop into cancer.

Figure 36a shows alveolar abscesses of both roots of a lower molar tooth as one of the lesions in the case of a lady who for two years had been treated unsuccessfully for symptoms of gastric or duodenal ulcer. After seeing the radiograph she recalled that three years previously there had been pain about this tooth, the only treatment having been by counter-irritant applications.

Figure 36b shows an alveolar abscess as one of the three dental foci of infection in a lady who had a large hemorrhage from the stomach with temporary recovery under absolute rest and suit-

Figure 37.—Radiograph to Determine Presence of Gastric Lesion Requiring Operation.

able diet. Later there were further gastric symptoms and a large six-hour residue as demonstrated by a radiograph.

The dentist thought it wise to extract this tooth and two others.

It seems as if *x*-ray examination of the stomach and of the teeth should go hand in hand in cases

FIGURE 38.—RADIOGRAPH TO DETERMINE PRESENCE OF GASTRIC OR INTESTINAL LESION REQUIRING OPERATION.

of suspected gastric or duodenal ulcer. Of course radiographs of the stomach and intestine like Figures 37 and 38 should be made to exclude the presence of a lesion requiring an abdominal operation.

CHAPTER VI

GENERAL CONCLUSIONS

The following general conclusions are to be drawn: A putrescent mass in the pulp chamber of a tooth may exist for months or years because the walls of the cavity cannot collapse and are incapable of throwing out granulations and eventually filling the cavity with healthy tissue, like the natural process of curing an abscess in the soft tissues of the body. This putrescent mass may constantly poison the bony tissues surrounding the apical foramen sufficiently to produce an effect clearly recognizable in a radiograph. This condition may be unknown to the patient and sometimes not reveal itself to the usual tests applied by the dentist. From this long-persisting source of infection secondary lesions and symptoms of the gravest and most diversified character may arise.

The *x*-ray is to be depended upon to show whether or not the source of trouble is connected with the teeth or the pneumatic sinuses, and if so, whether the trouble is due to malposition and unnatural pressure or to infection. It would be a mistake to regard every case as due to the teeth and proceed to sacrifice the latter without first making a radiograph which may acquit them of any complicity in the matter.

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INDEX

Alveolar abscess, 10
  cysts differentiated from, 31
  fistulous type of, 14
  flaring foramen differentiated from, 35
  impacted wisdom tooth differentiated from, 34
  in teeth already treated, 14
  malocclusion differentiated from, 29
  origin of, 11
  pulp-stones differentiated from, 29
  symptoms of, 10
  treatment of, 10
    dentists', 12
    in mild cases, 12
  unerupted tooth and, 33
Anemia, pernicious, dental infection and, 37
Arterial hypertension, 56
Arthritis, 46
  dental infections and, 37
Autogenous vaccines in systemic diseases due to dental infection, 39

Bacteriological studies of the mouth, 36

Cardiac lesions. *See* Heart, lesions of.
Clinical studies of infections, 37
Cough, paroxysmal, 56
Cysts, 31
  dentigerous, 33

Dental foci of infection in systemic diseases, *x*-ray examination for, 38
Dental infections, 10
  bacteriological studies of, 36
  lesions and symptoms secondary to, 40
Dentigerous cysts, 33
Duodenal ulcer, 64
Dying nerve, removal of, 12
  untreated, infection from, 13

Endocarditis, 46
Exophthalmic goitre, 61
Eye, diseases of, 62

Fistulous type of alveolar abscess, 14
  of pyorrhea alveolaris, 24
Flaring foramen, 35

Gastric ulcer, 64
  dental infections and, 37
Goitre, exophthalmic, 61

Heart, lesions of, 59
    dental infections and, 37
Hemiplegia, 46

High-frequency currents in treatment of pyorrhea alveolaris, 22

Impacted wisdom tooth, 34
Infection, bacteriological studies of the mouth and, 36
clinical studies of, 37
dental, 10
foci of, in systemic diseases, *x*-ray examination for, 38
lesions and symptoms secondary to, 40
focus of, value of *x*-ray in revealing, 26
from untreated dying nerve, 13
in sinuses, 25
in teeth (*see also* Infection, dental), 10
Ipecac alkaloid emetine in treatment of pyorrhea alveolaris, 23

Malocclusion, 29
Meningitis, 46
Myocarditis, dental infection and, 39

Nephritis, dental infections and, 37
Nerve, dying, removal of, 12
untreated, infection from, 13
Neuralgia, 55
dental infections and, 37
Neurasthenia, 40
Neuritis, 55

Paroxysmal cough, 56
Pericarditis, dental infection and, 39
Pernicious anemia, dental infections and, 37
Pleurisy, 46
Pneumatic sinuses, infection in, 25
lesions and symptoms secondary to, 40
value of *x*-ray diagnosis in, 26
Pulp-stones, 29
Pyorrhea alveolaris, 15
cases, 24
causes of, 17
from broken instrument, 19
from extruded root-filling, 18
from retained root, 19
from unerupted tooth, 17, 24
in otherwise healthy mouths, 39
painfulness of, 20
symptoms of, 15
treatment of, 21
by dentist, 21
by ultra-violet ray, 22
by *x*-ray, 21
high-frequency currents in, 22
ipecac alkaloid emetine in, 23
with fistulous opening, 24
Pyorrheal pocket, demonstration of, 16

Radiographic diagnosis of dental infection, 26
in systemic diseases, 38
Retained root a cause of pyorrhea alveolaris, 19

Rheumatism, use of vaccines in, 39
Riggs' disease (*see also* Pyorrhea alveolaris), 15
Roentgenographic diagnosis of dental infection, conclusions, 70

Sciatica, 55
Sinuses, pneumatic, infection in, 25
  lesions and symptoms secondary to, 40
  value of *x*-ray in diagnosis of, 26
Spinal cord, lesions of, 63
Stomach, ulcer of. *See* Gastric ulcer.
Systemic diseases, alveolar abscess and pyorrhea as causes of, 37
  due to dental infection, use of vaccines in (*see also* diseases by name), 39
  x-ray examination for dental foci of infection in, 38

Teeth, infections of, 10
  bacteriological studies of, 36
Teeth, infections of, lesions and symptoms secondary to, 40
  x-ray examination of, for foci of infection in systemic diseases, 38
Tic douloureaux, 55
Tinnitus aurium, 63
Tuberculosis, 40

Ulcer, gastric and duodenal, 64
Ultra-violet ray in treatment of pyorrhea alveolaris, 22
Unerupted tooth, a cause of pyorrhea alveolaris, 17, 24
  combined with alveolar abscess, 33

Vaccines, use of, in systemic diseases due to dental infection, 39

X-ray examination for dental foci of infection, 26
  in systemic diseases, 38
X-ray treatment of pyorrhea alveolaris, 21

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